# Installation / User Manual

## APsystems YC250-NA

### Photovoltaic Grid-connected Microinverter

Version 5.0

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(For USA / Canada)

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# Important Safety Instructions

This manual contains important instructions to follow during installation and maintenance of the APsystems Photovoltaic Grid-connected Inverter (Microinverter). To reduce the risk of electrical shock and ensure the safe installation and operation of the APsystems Microinverter, the following symbols appear throughout this document to indicate dangerous conditions and important safety instructions.

SAVE THESE INSTRUCTIONS! *This manual contains important instructions for models YC250-NA that must be followed during installation and maintenance of the Photovoltaic Grid-connected Inverter.*

Specifications subject to change without notice - please ensure you are using the most recent update found at www.APsystems.com

**WARNING:** This indicates a situation where failure to follow instructions may cause a serious hardware failure or personnel danger if not applied appropriately. Use extreme caution when performing this task.

WARNING SYMBOL

**NOTE:** This indicates information that is important for optimized Microinverter operation. Follow these instructions closely.

NOTE SYMBOL

## Safety Instructions

- ✓ **Do NOT** disconnect the PV module from the APsystems Microinverter without first disconnecting the AC power.
- ✓ Only qualified professionals should install and/or replace APsystems Microinverters.
- ✓ Perform all electrical installations in accordance with local electrical codes.
- ✓ Before installing or using the APsystems Microinverter, please read all instructions and cautionary markings in the technical documents and on the APsystems Microinverter system and the solar-array.
- ✓ Be aware that the body of the APsystems Microinverter is the heat sink and can reach high temperatures. To reduce risk of burns, do not touch the body of the Microinverter.
- ✓ **Do NOT** attempt to repair the APsystems Microinverter. If it fails, contact APsystems Customer Support (844-666-7035) to obtain an RMA number and start the replacement process. Damaging or opening the APsystems Microinverter will void the warranty.

# Radio interference statement

FCC Compliance：The equipment can comply with the limits for a class B digitaldevice,pursuant to part 15 of the FCC Rules, which are designed to protect against harmful interference in a residential installation. The equipment could radiate radio frequency energy and this might cause harmful interference to radio communications if not following the instructions when installing and using the equipment. But there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, the following measures might resolve the issues:

A) Relocate the receiving antenna and keep it well away from the equipment.

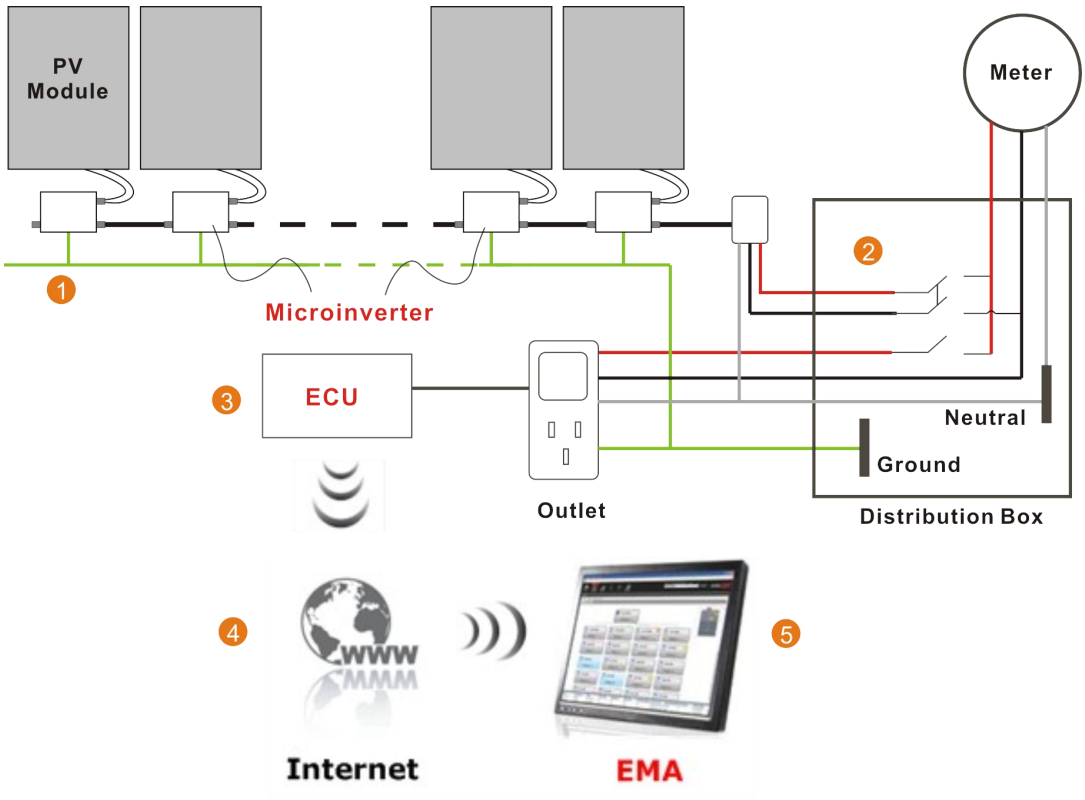
B) Consult the dealer or an experienced radio / TV technical for help.

Changes or modifications not expressly approved by the party responsible for compliance may void the user's authority to operate the equipment.

# APsystems Microinverter System Introduction

The APsystems Microinverter is used in utility-interactive grid-tied applications, comprised of three key elements:

- APsystems Microinverter
- APsystems Energy Communication Unit (ECU)
- APsystems Energy Monitor and Analysis (EMA) web-based monitoring and analysis system




1 APsystems Microinverter
2 AC power line
3 APsystems ECU
4 Ethernet Router
5 APsystems EMA

Figure 1

This integrated system improves safety; maximizes solar energy harvest; increases system reliability, and simplifies solar system design, installation, maintenance, and management.

## APsystems Microinverters maximize PV energy production

Each PV module has individual Maximum Peak Power Tracking (MPPT) controls, which ensures that the maximum power is exported to the utility grid regardless of the performance of the other PV modules in the array. When PV modules in the array are affected by shade, dust, orientation, or any situation in which one module underperforms compared with the other units, the APsystems Microinverter ensures top performance from the array by maximizing the performance of each module within the array.

## More reliable than centralized or string inverters

The distributed APsystems Microinverter system ensures that no single point of system failure exists across the PV system. APsystems Microinverters are designed to operate at full power at ambient outdoor temperatures of up to 149°F (65°C). The inverter housing is designed for outdoor installation and complies with the NEMA 6 environmental enclosure rating.

## Simple to install

You can install individual PV modules in any combination of module quantity, orientation, type, and power rate.

## Smart system performance monitoring and analysis

The APsystems Energy Communication Unit (ECU) is installed by simply plugging it into any wall outlet and providing an Ethernet or Wi-Fi connection to a broadband router or modem. After installing the ECU, the full network of APsystems Microinverters automatically reports to the APsystems Energy Monitor and analysis (EMA) web server. The EMA software displays performance trends, informs you of abnormal events, and controls system shutdown when it is needed. (See ECU manual for instructions.)

# APsystems Microinverter YC250-NA Introduction

The APsystems YC250A/I-NA Microinverters connect with the Split-phase grid, and operate with most 60 and 72 cell PV modules. For more information, please see the Technical Data page (p.17) of this manual, or sign in APsystems website to obtain a solar panel list which can match with APsystems Microinverters: www.APsystems.com

| Model Number | AC grid | PV Module | Max. # Per branch | Module Connector |
|---|---|---|---|---|
| YC250A-NA | 60Hz/240V | 60,72 Cell | 17 for 20A breaker | MC-4 Type or Customize |
| YC250I-NA | 60Hz/240V | 60,72 Cell | 17 for 20A breaker | MC-4 Type or Customize |

# APsystems Microinverter System Installation

A PV system using APsystems Microinverters is simple to install. Each Microinverter easily mounts on the PV racking, directly beneath the PV module(s). Low voltage DC wires connect from the PV module directly to the Microinverter, eliminating the risk of high DC voltage. Installation MUST comply with local regulations and technical rules.

Special Statement! *An AC GFCI device **should not** be used to protect the dedicated circuit to the APsystems microinverter even though it is an outside circuit. None of the small GFCI devices (5mA-30 mA) are designed for back feeding and will be damaged if back feed. In a similar manner, AC AFCIs have not been evaluated for back feeding and may be damaged if back feed with the output of a PV inverter.*

**WARNING:** Perform all electrical installations in accordance with local electrical codes.

**WARNING:** Be aware that only qualified professionals should install and/or replace APsystems Microinverters.

**WARNING:** Before installing or using an APsystems Microinverter, please read all instructions and warnings in the technical documents and on the APsystems Microinverter system itself as well as on the PV array.

**WARNING:** Be aware that installation of this equipment includes the risk of electric shock.

**WARNING:** Do not touch any live parts in the system, including the PV array, when the system has been connected to the electrical grid.

**NOTE:** Strongly recommend to install Surge protection Devices in the dedicated meter box.

## Additional Installation components from APsystems

- AC branch end cable (1 per branch, sold separately)
- Protective end cap (1 per branch, sold separately)

## Required Parts and Tools from you

In addition to your PV array and its associated hardware, you will need the following items:

- An AC connection junction box
- Mounting hardware suitable for module racking
- Sockets and wrenches for mounting hardware
- Continuous grounding conductor and grounding washers
- A Phillips screwdriver
- A torque wrench

# Installation Procedures

APsystems Microinverters are designed to only operate when they can sense power coming from the grid. Even if they are plugged into the solar array, they will not turn themselves on until they can read power from the grid.

**WARNING:** Do NOT connect APsystems Microinverters to the utility grid or energize the AC circuit until you have completed all of the installation procedures as described in the following sections.

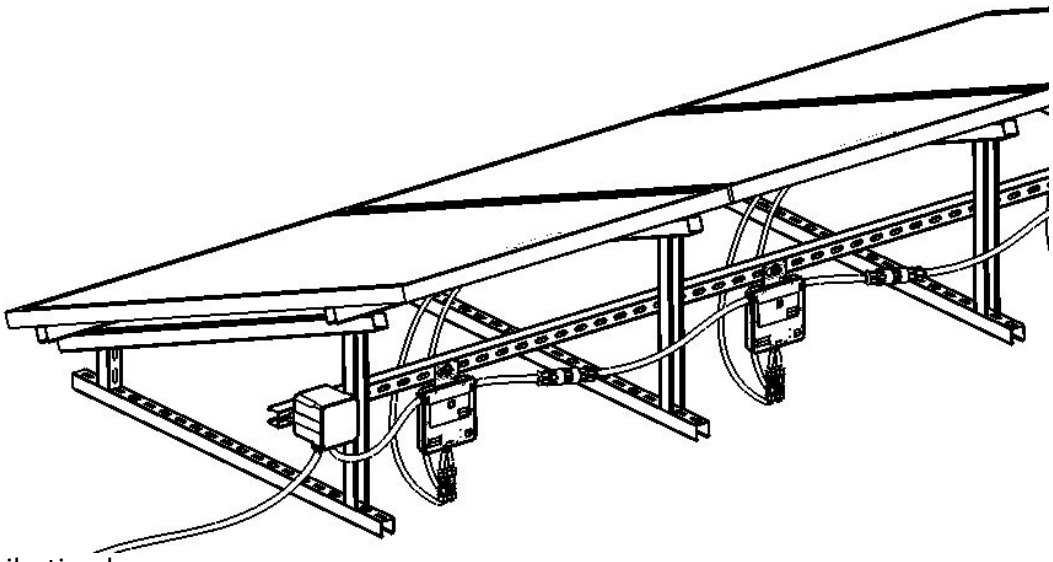



Figure 2

## Step 1 - Installing the AC Branch Circuit Junction Box

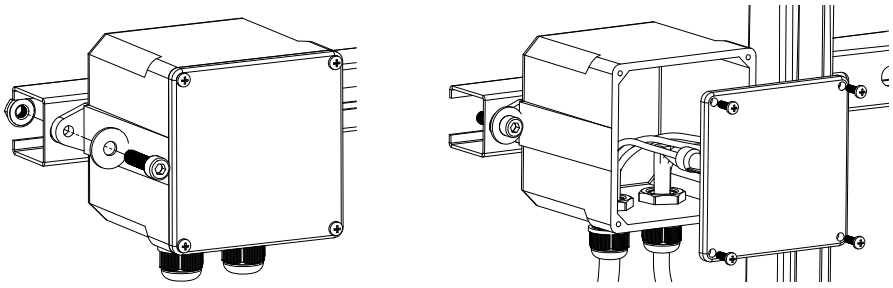


Figure 3

a. Install an appropriate junction box at a suitable location on the PV racking system (typically at the end of a branch of modules).

b. Connect the open wire end of the AC branch end cable into the junction box using an appropriate gland or strain relief fitting.

c. Wire the conductors: L1- RED; L2 - BLACK; N -WHITE.

d. Connect the AC branch circuit junction box to the point of utility interconnection.

## Step 2 - Attaching the APsystems Microinverters to the Racking or the PV Module Frame

a. Mark the location of the Microinverter on the rack, with respect to the PV module junction box or any other obstructions.
b. Mount one Microinverter at each of these locations using hardware recommended by your module racking vendor.
c. GROUNDING WASHER: If using the appropriate grounding washer (check with a licensed electrician), attach the grounding washer between the frame and the Microinverter.

Option 1:

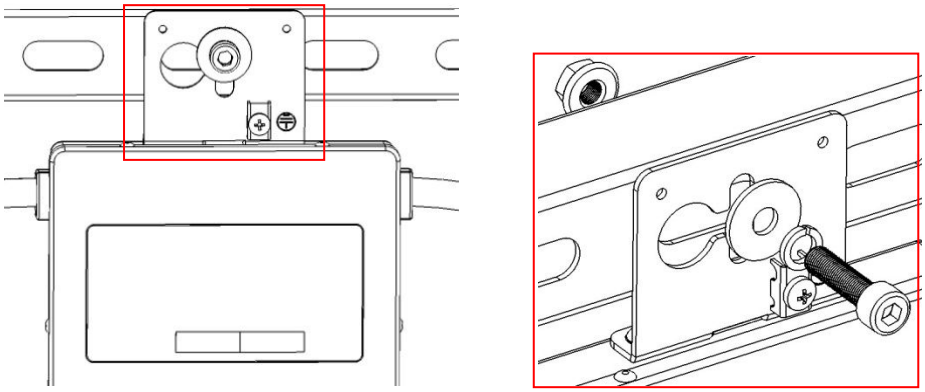


Figure 4

Option:2

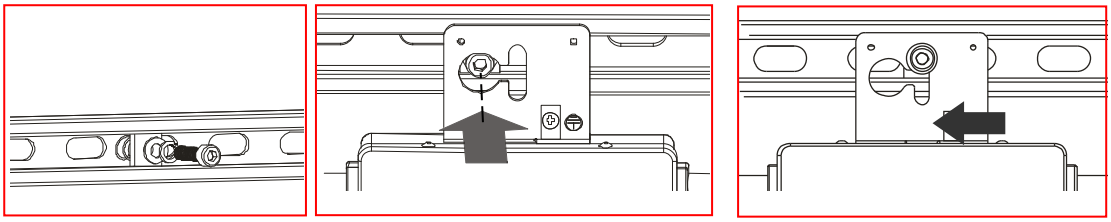


Figure 5

**WARNING:** Prior to installing any of the microinverters, verify that the utility voltage at the point of common connection matches the voltage rating on microinverter label.

**WARNING:** Do not mount the Microinverter in a location that allows exposure to direct sunlight. Allow a minimum of 3/4”(1.5cm.) between the roof and the bottom of the Microinverter to allow proper air flow.

## Step 3 - Connecting the APsystems Microinverter AC Cables

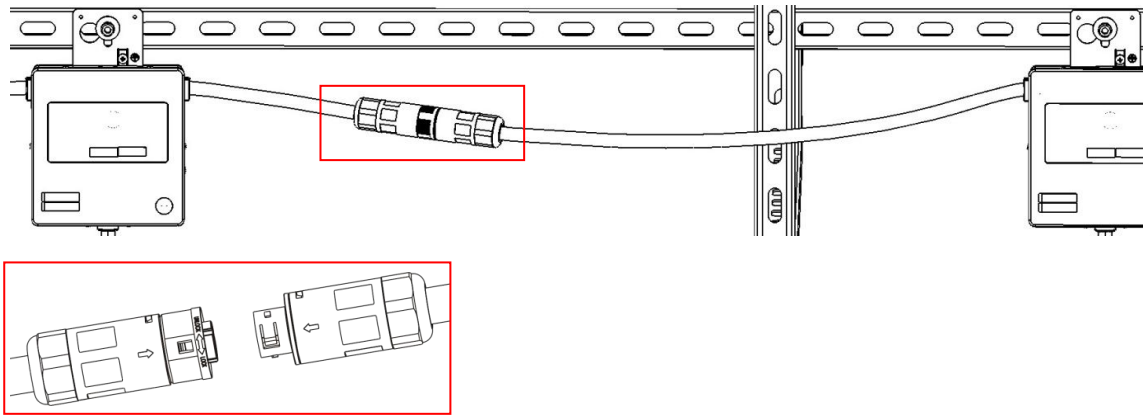


Figure 6

*Best Practice:* *Use screwdriver to split the Main connectors.*

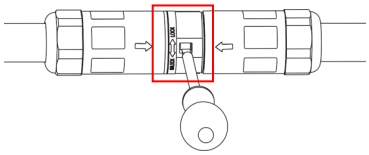


Figure 7

a. Check the Microinverter technical data page (P.18) for the maximum allowable number of Microinverters on each AC branch circuit.

b. Plug the AC female connector of the first Microinverter into the male connector of the next Microinverter, and so on, to form a continuous AC branch circuit.

c. Install a protective end cap on the open AC connector of the last Microinverter in the AC branch circuit.

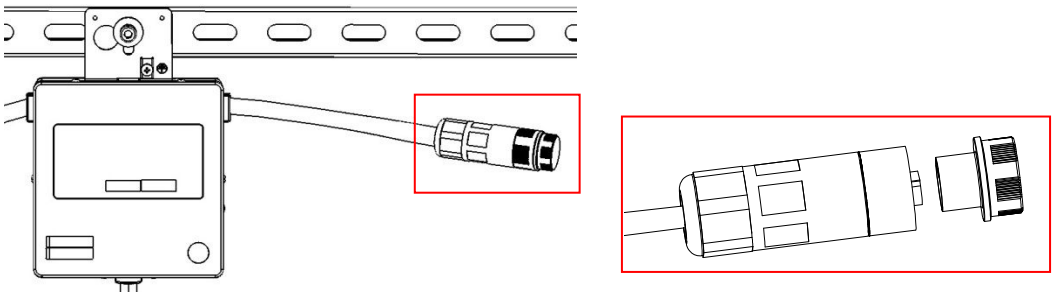


Figure 8

**WARNING:** Do NOT exceed maximum number of Microinverters in an AC branch circuit, as displayed on the Technical Data page (p.17) of this manual.

**NOTE:** Please contact with ALTENERGY POWER SYSTEM Inc for the purchase of AC extended cables when microinverters which are installed space far and AC cable is not long enough.

## Step 4 - Ground the System

If you already use grounding washers (WEEB) to ground the Microinverter chassis to the PV module racking as described in Step 2, skip this step.

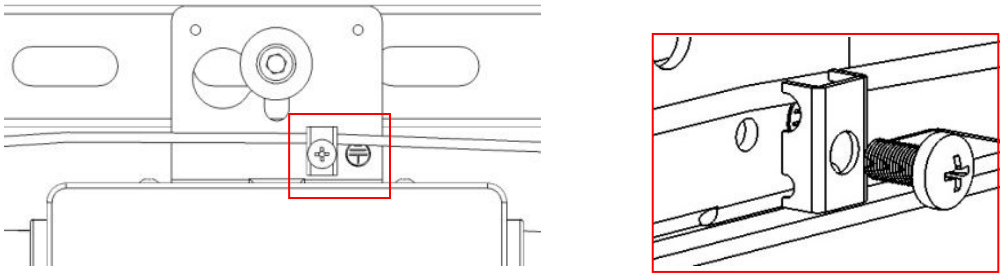


Figure 9

Each APsystems Microinverter comes with a ground clamp that can accommodate a single #6 awg strand and #4 awg solid conductor. Check your local electrical code for grounding conductor sizing requirements. Connect the grounding electrode conductor to the microinverter ground clamp.

**NOTE:** The AC output neutral is not bonded to ground inside the microinverter.

## Step 5 - Connecting APsystems Microinverters to the PV Module

Connect the DC cables from the PV Modules to the Microinverter per the diagram below:

**NOTE:** When plugging in the DC cables, the Microinverter should immediately blink green three times. This will happen as soon as the cables are plugged in and will show that the Microinverter is functioning correctly. This entire check function will start and end within 5 seconds of plugging in the unit, so pay careful attention to these lights when connecting the DC cables.

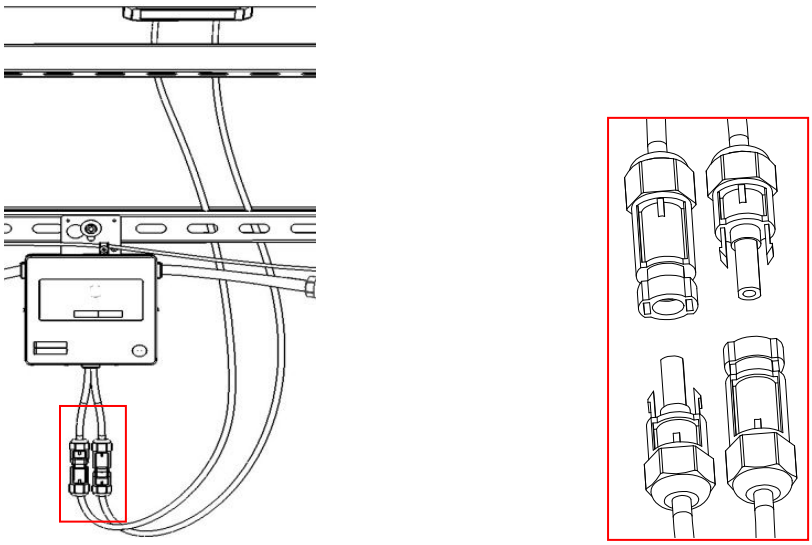


Figure 10

**WARNING:** Insure that all AC and DC wiring is correct. Check that none of the AC and DC wires are pinched or damaged. Be sure that all junction boxes are properly closed.

## Step 6 - Completing the APsystems Installation Map

Fill in the APsystems Registration Cards, which provide system information and the installation map. Feel free to provide your own layout if a larger or more intricate installation map is required. The layout map provided is designed to accomodate labels in vertical or horizontal orientation to meet all the field PV connections.

a. Each APsystems Microinverter has removable serial number labels. Peel labels off, affix one to the respective location on the APsystems installation map, and affix another label to the PV module frame which is easy to see. The warranty cards can obtain from the appendix of this manual or APsystems website www.APsystems.com
b. Fill the warranty cards and email to APsystems at emasupport@altenergy-power.com
c. APsystems will create the EMA account and email you the account information. Then you can use the EMA website to view detailed performance of your PV system. You can learn more information on energy monitoring and analysis system from APsystems website www.APsystems.com

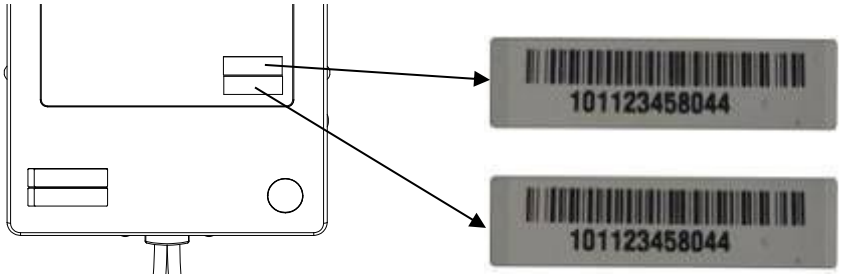



Figure 11

**NOTE:** 1. Step 1～6 can change sequence for convenience of installation.
2. Warranty card is located in Appendix last page of this manual.

# APsystems microinverter system operating instructions

## To operate the APsystems microinverter PV system:

1. Turn ON the AC circuit breaker on each microinverter AC branch circuit.

2. Turn ON the main utility-grid AC circuit breaker. Your system will start producing power after a five-minute waiting time.

3. The units should start blinking green every 2 seconds five minutes after turning on the AC circuit breaker. This means they are producing power normally, but have not yet connected to the ECU. After the ECU has been plugged in and acknowledges the Microinverters, they will start to blink green every 10 seconds.

4. Plug in the ECU and follow the instructions according to the manual for the ECU.

5. The APsystems Microinverters will start to send performance data over power line to the ECU. The time required for all the Microinverters in the system to report to the ECU will vary with the number of Microinverters in the system. You can verify proper operation of the APsystems Microinverters via the ECU. See the ECU Installation and Operation Manual for more information.

**NOTE:** Once AC power is applied, about 0.1A current and 25VA(W) power for each microinverter may be measured with a meter. This Current and Power are Reactive. The inverters ARE NOT operating. After an over 300s waiting time, the inverters will start operation.

# Troubleshooting

Qualified personnel can use the following troubleshooting steps if the PV system does not operate correctly:

## Status Indications and Error Reporting

### Start up LED

One quick red light followed by three short green blinks when DC power is first applied to the Microinverter indicates a successful Microinverter startup.

### Operation LED

**Flashing Slow Green (10 sec. gap)** - Producing power and communicating with ECU
**Flashing Fast Green (2 sec. gap) -** Producing power and not communicating with ECU over 60mins
**Flashing Red** - Not producing power

### GFDI Error

A solid red LED indicates the Microinverter has detected a Ground Fault Detector Interrupter (GFDI) error in the PV system. Unless the GFDI error has been cleared, the LED will remain red and the ECU will keep reporting the fault.
After the ground fault error is fixed, follow the instructions in the ECU Installation and Operation Manual to clear this GFDI error reporting.

### Other Faults

All other faults are reported to the ECU. Refer to the ECU Installation and Operation Manual for a list of additional faults and troubleshooting procedures.

**WARNING:** Only qualified personnel should directly handle the APsystems microinverter.

**WARNING:** Never disconnect the DC wire connectors under load. Ensure that no current is flowing in the DC wires prior to disconnecting. An opaque covering may be used to cover the module prior to disconnecting the module.

**WARNING:** Always disconnect AC power before disconnecting the PV module wires from the APsystems microinverter. Either disconnecting by the appropriate AC circuit breaker or unplugging the first AC connector of the first Microinverter in a branch circuit is suitable as a means of disconnection.

**WARNING:** The APsystems microinverter is powered by PV module DC power. AFTER disconnecting the DC power, when reconnecting the PV modules tothe Microinverter, be sure to watch for the three short LED flashes.

## Troubleshooting a non-operating APsystems Microinverter

There are two possible overall areas of trouble:

A. The Microinverter itself may be having problems.
B. The Microinverter itself is working fine but it is having trouble communicating with the ECU. The items below refer to Microinverter issues, not communication issues (addressed in the ECU manual).

A quick way to tell whether the issue is the Microinverter or a communication problem with the ECU:

1. **Diagnosing from the Microinverter:** A red light – either blinking or solid on the Microinverter, or no light at all. No light, or a red light, means it is definitely a Microinverter problem.

2. **Diagnosing from the ECU:**
   **a. No-Data-Display:** This is probably a communication issue- not a Microinverter problem.
   **b. Problems with erratic display:** Data is displayed for some period and then no data is displayed: most likely a communication issue.
   **c. 0 watts, or 2 watts:** Possibly a Microinverter problem
   **d. Erratic data display** that is not coordinating with data displays from other units: most likely a Microinverter problem.

### To troubleshoot a non-operating APsystems Microinverter, Follow the steps below in order:

1. Verify the utility voltage and frequency are within ranges shown in the Technical Data section of this manual.
2. Check the connection to the utility grid. Verify utility power is present at the inverter in question by removing AC, then DC power. **Never disconnect the DC wires while the microinverter is producing power.** Re-connect the DC module connectors and watch for three short LED flashes.
3. Check the AC branch circuit interconnection between all the microinverters. Verify each inverter is energized by the utility grid as described in the previous step.
4. Make sure that any AC breaker are functioning properly and are closed.
5. Check the DC connections between the microinverter and the PV module.
6. Verify the PV module DC voltage is within the allowable range shown in the Section 8 Technical Data of this manual.
7. If the problem persists, please call APsystems Energy customer support.

**WARNING:** Do not attempt to repair the APsystems microinverter. If troubleshooting methods fail, please return the microinverter to your distributor for replacement.

# Replace a microinverter

## Follow the procedure to replace a failed APsystems Microinverter.

A. Disconnect the APsystems Microinverter from the PV Module, in the order shown below:
   1. Disconnect the AC by turning off the branch circuit breaker.
   2. Disconnect the first AC connector in the branch circuit.
   3. Disconnect the PV module DC wire connectors from the microinverter.
   4. Remove the Microinverter from the PV array racking.
   5. Cover the module with an opaque cover.

B. Install a replacement Microinverter to the rack. Remember to observe the flashing LED light as soon as the new Microinverter is plugged into the DC cables.

C. Connect the AC cable of the replacement Microinverter and the neighboring Microinverter to complete the branch circuit connections.

D. Close the branch circuit breaker, and verify operation of the replacement Microinverter.

**WARNING:** Be sure to verify the voltage and current specifications of your PV module match with those of the Microinverter. Refer to the APsystems website www.APsystems.com for a list of approved PV modules.

**WARNING:** You must match the DC operating voltage range of the PV module with the allowable input voltage range of the APsystems Microinverter.

**WARNING:** The maximum open circuit voltage of the PV module must not exceed the specified maximum input voltage of the APsystems

# APsystems YC250-NA Microinverter Datasheet

## Input Data (DC)

| | |
|---|---|
| Recommended PV Module Power (STC)Range | 180W-310W |
| MPPT Voltage Range | 22V-45V |
| Operation Voltage Range | 16V-52V |
| Maximum Input Voltage | 55V |
| Startup Voltage | 22V |
| Maximum Input Current | 12A |

## Output Data (AC)

| | |
|---|---|
| Nominal Output Voltage | 240V* |
| Maximum Continuous Output Power | 225W |
| Nominal Output Current | 0.937A |
| Default Output Voltage Range | 211V-264V** |
| Maximum Output Fault Current (peak) | 41.6A |
| Maximum Output Fault Current (RMS) | 2.63A |
| Maximum Output Fault Current Duration | 1.615ms |
| Reactive Current | 0.1A |
| Extended Output Voltage Range | 181V-298V |
| Nominal Output Frequency | 60Hz |
| Default Output Frequency Range | 59.3Hz-60.5Hz** |
| Extended Output Frequency Range | 55.1Hz -64.9Hz |
| Power Factor | >0.99 |
| Total Harmonic Distortion | <3% |
| Maximum Units per Branch | 17 for 20A Breaker*** |

## Efficiency

| | |
|---|---|
| Peak Efficiency | 95.5% |
| CEC Weighted Efficiency | 95% |
| Nominal MPPT Efficiency | 99.5% |
| Night Power Consumption | 120mW |

## Mechanical Data

| | |
|---|---|
| Operating Ambient Temperature Range | -40° F to +149 ° F (-40°C to +65°C ) |
| Storage Temperature Range | -40 °F to +185 °F (-40°C to +85°C ) |
| Dimensions (W x H x D) | 160mm × 150mm × 29mm (6.3” × 5.9” × 1.1”) |
| Weight | 3.3lbs/1.5kg |
| AC CABLE | 12AWG |
| Enclosure Rating | NEMA 6 |
| Cooling | Natural Convection |

## Features & Compliance

| | |
|---|---|
| Communication | Power line |
| Design Lifetime | 25yrs |
| Emissions & Immunity (EMC) Compliance | FCC Part15; ANSI C63.4;ICES-003 |
| Monitoring | Life monitoring via EMA software |
| Safety Class Compliance | UL1741，CSA C22.2 No.107.1-01 |
| Grid Connection Compliance | IEEE1547 |

Specifications subject to change without notice - please ensure you are using the most recent update found at www.APsystems.com

*The default AC output is 240V mode. For 208V mode, please set the AC output range through ECU.
**Programmable through ECU to meet customer need.
***Depending on the local regulations.

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## Sample Wiring Diagram - 120V/ 240V Split Phase

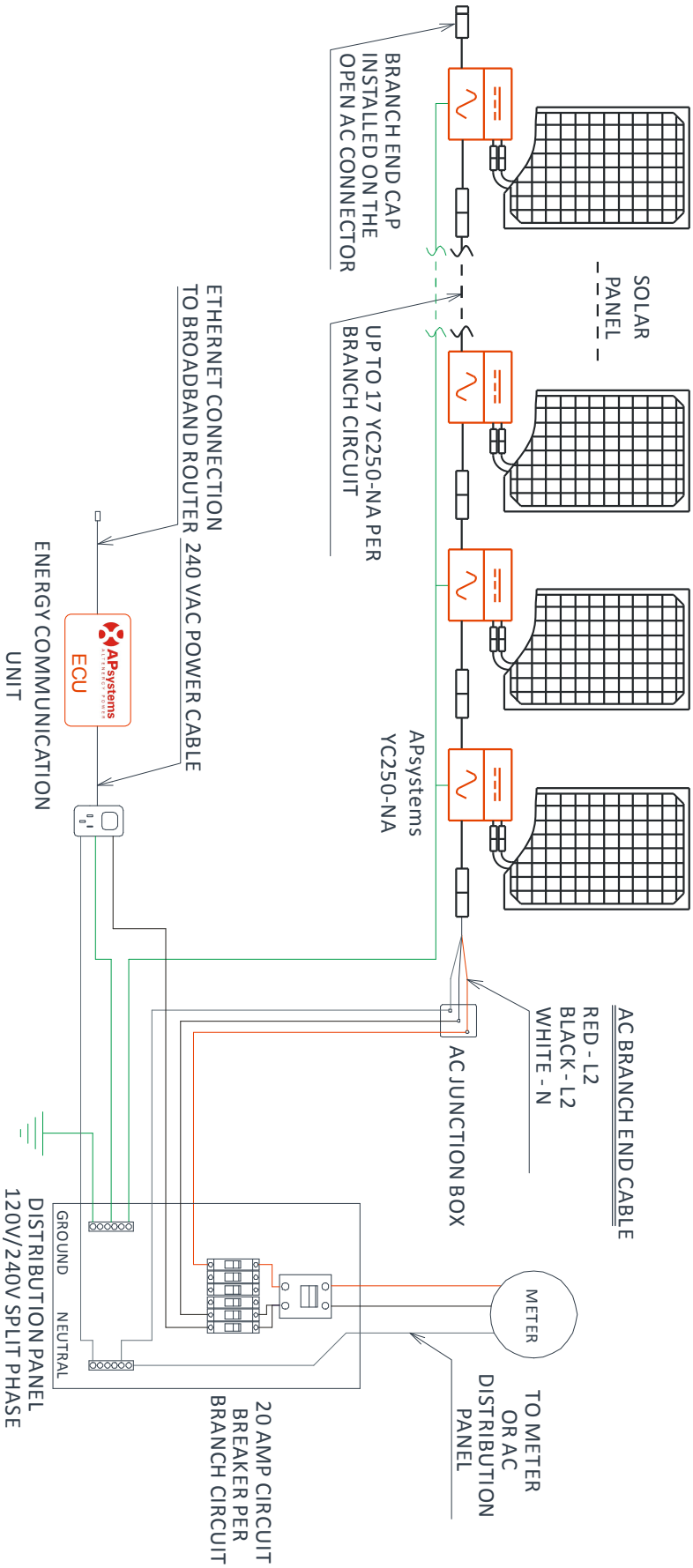


Figure 14

# APsystems Microinverter &Energy Communication Unit

# Warranty Card

The APsystems Installation Map is a diagram of the physical location of each microinverter in your PV installation. Each APsystems microinverter has a removable serial number label located on the mounting plate. Peel the label and affix it to the respective location on the APsystems installation map.

Installation Map Template

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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To register your APsystems microinverter, please mail this warranty registration card to: emasupport@altenergy-power.com